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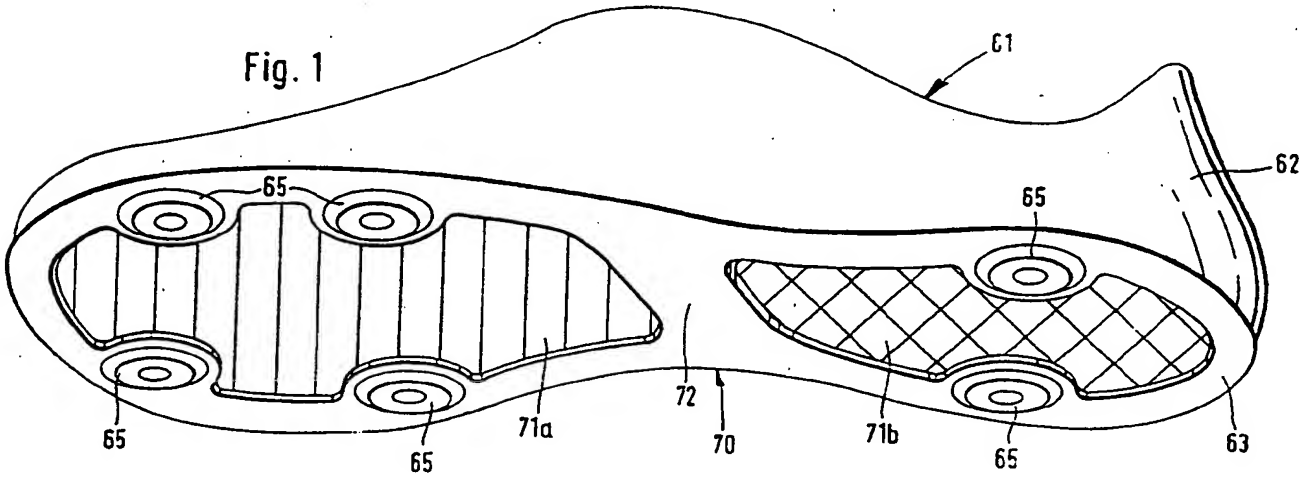
(54) Sole and sports shoe

(57) A shoe sole comprises at least one fibre reinforced part (71a, 71b) comprising a plastic matrix with fibres embedded therein, serves as a supporting component of the sole in a shoe sole, and is inseparably joined by welding or chemical bonding to the remainder of the sole body (63).

The invention also includes a sports shoe 61 provided with such a sole.

Fig. 1



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy

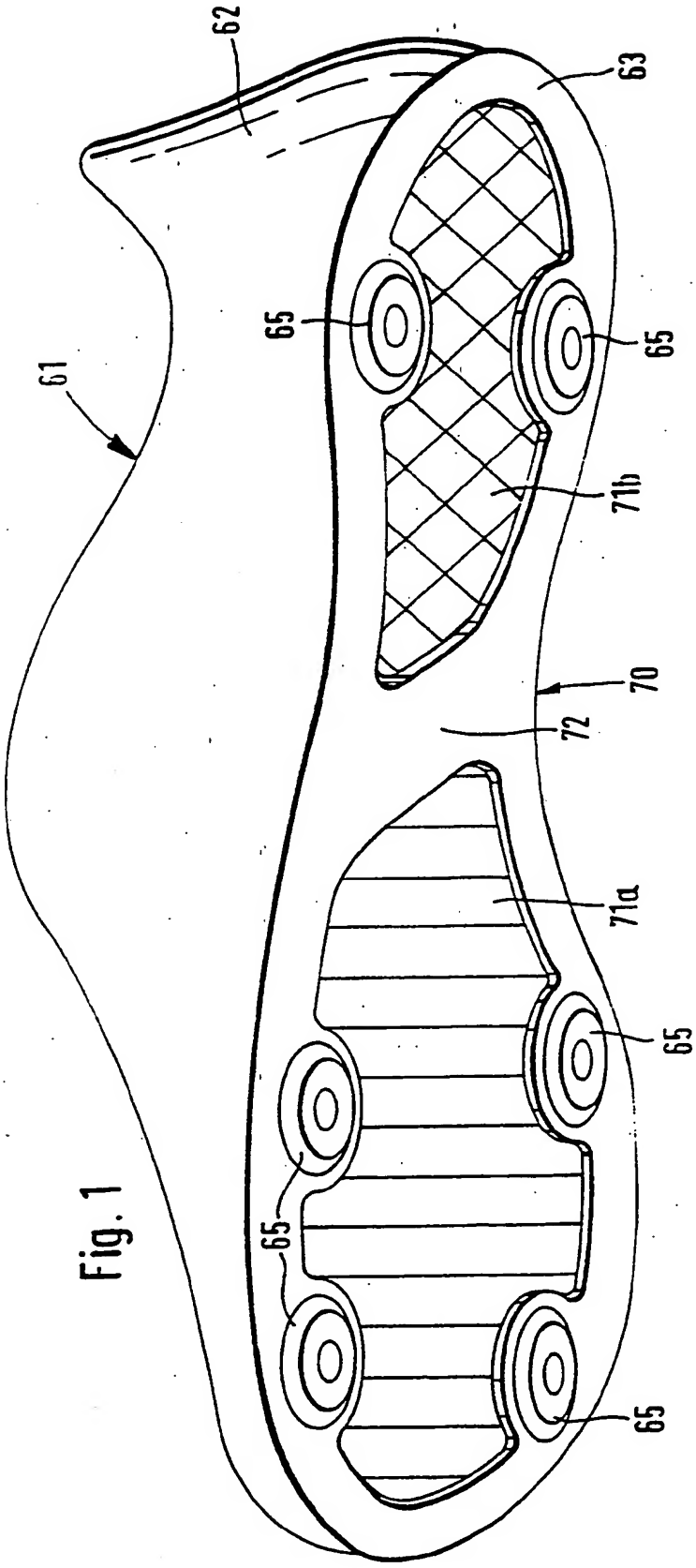

Fig. 1

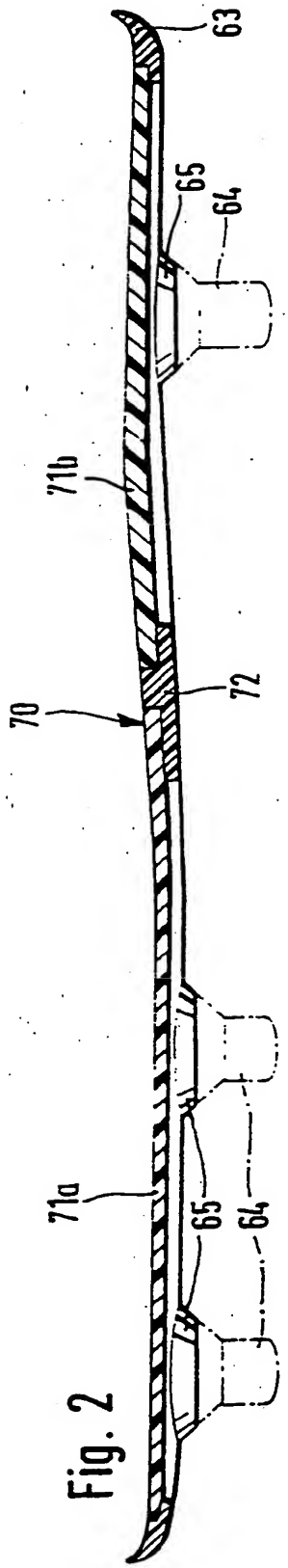

Fig. 2

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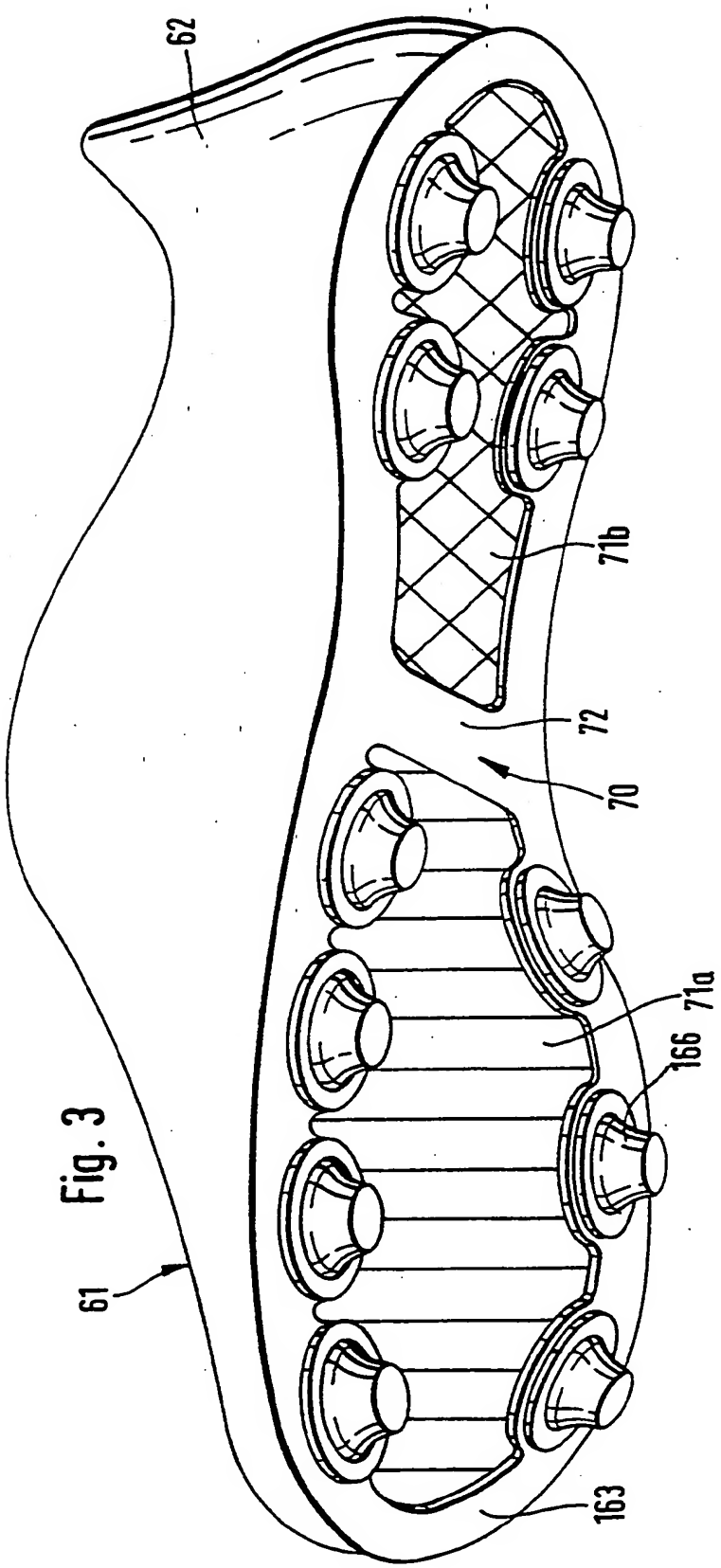

Fig. 3

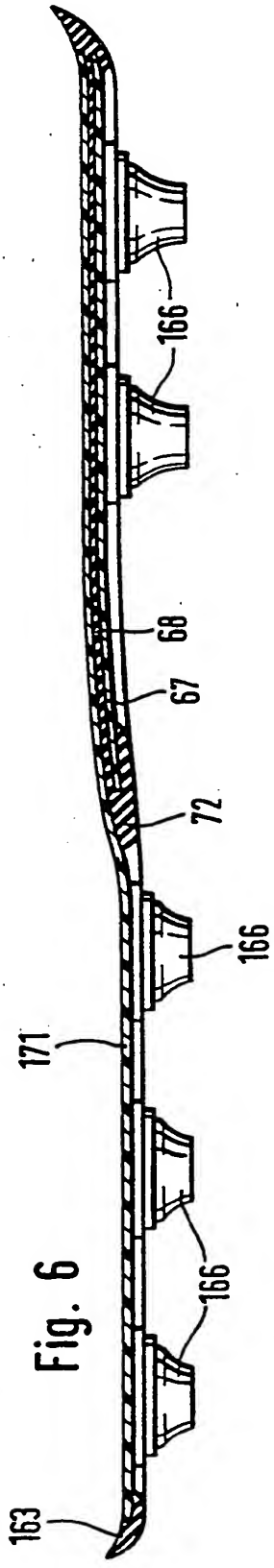

Fig. 6

Fig. 4

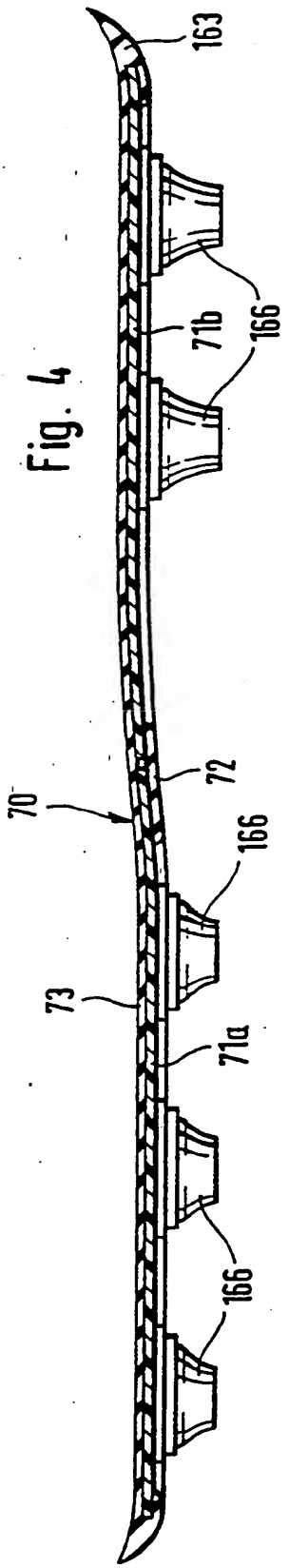

Fig. 5

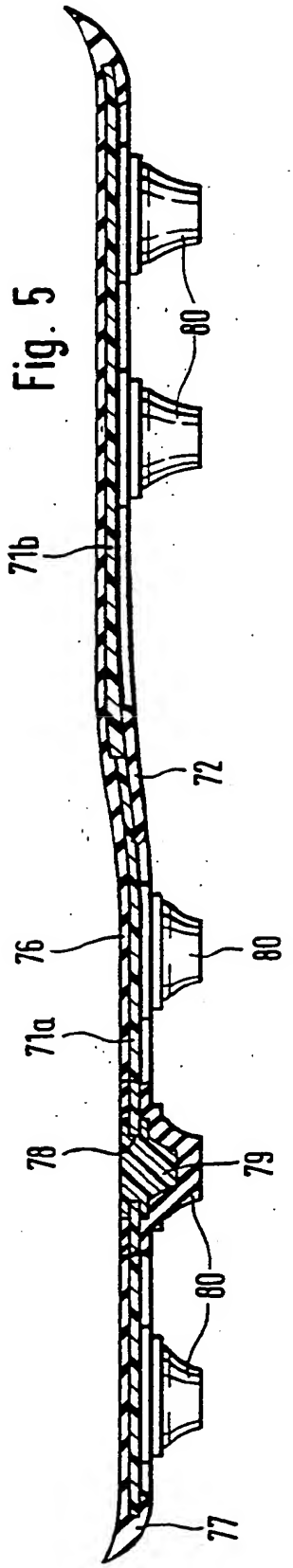

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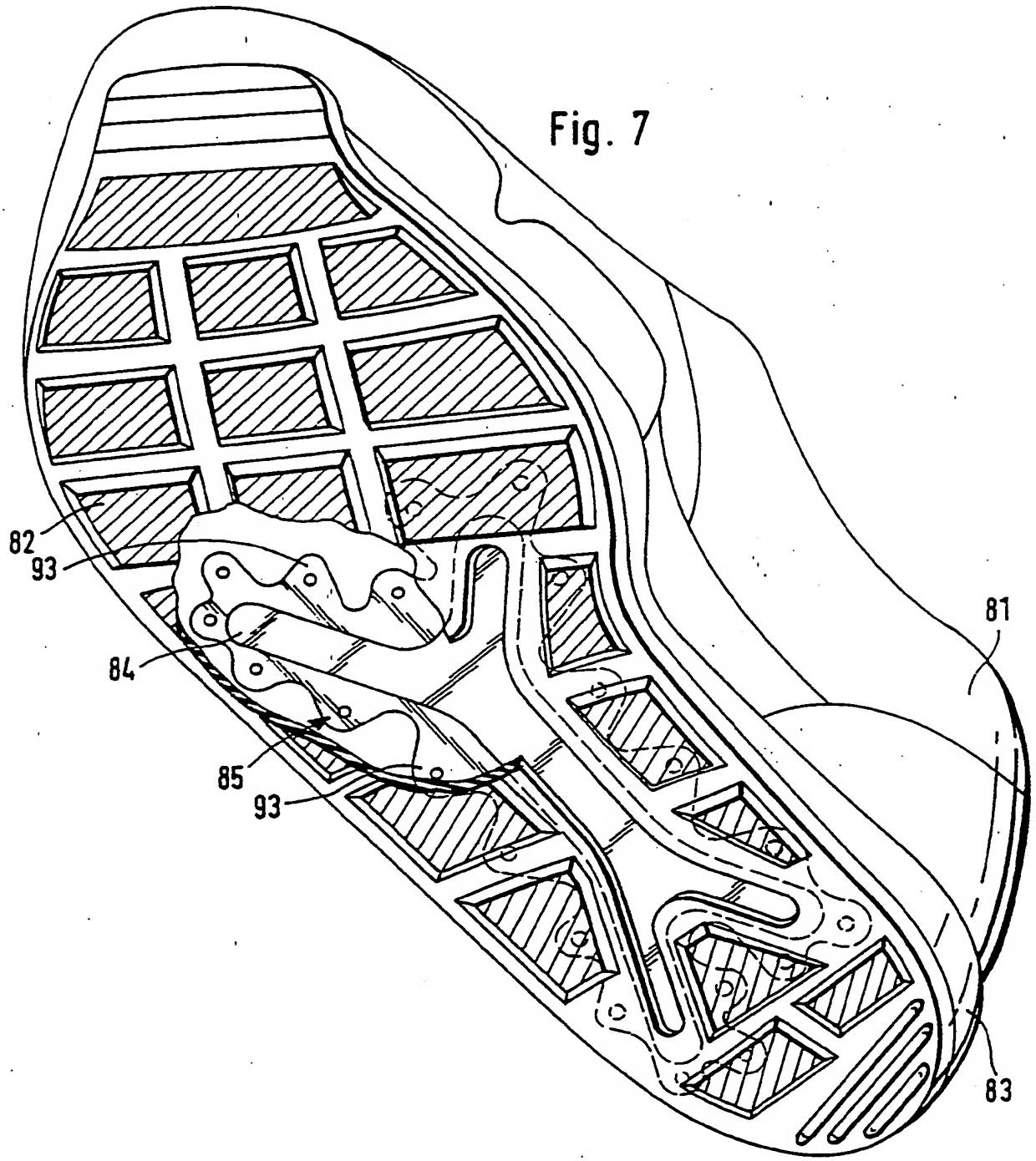
Fig. 7



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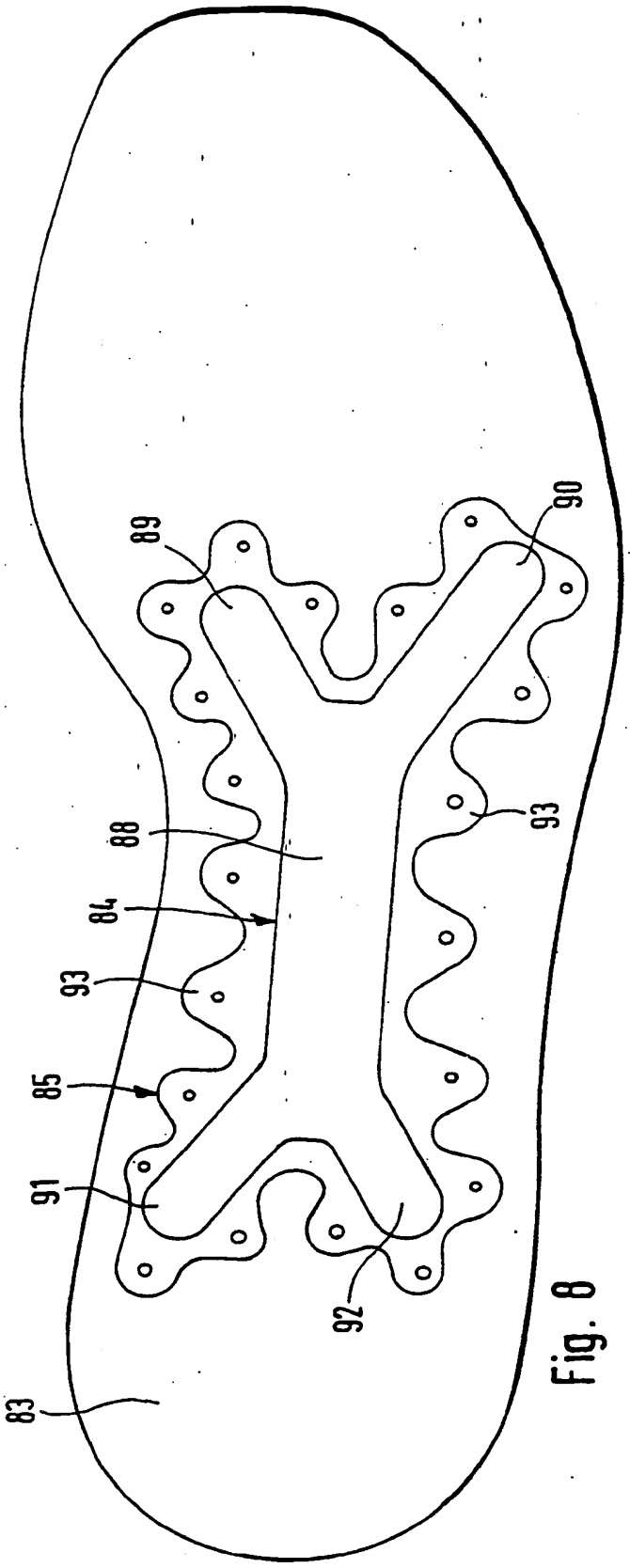

Fig. 8

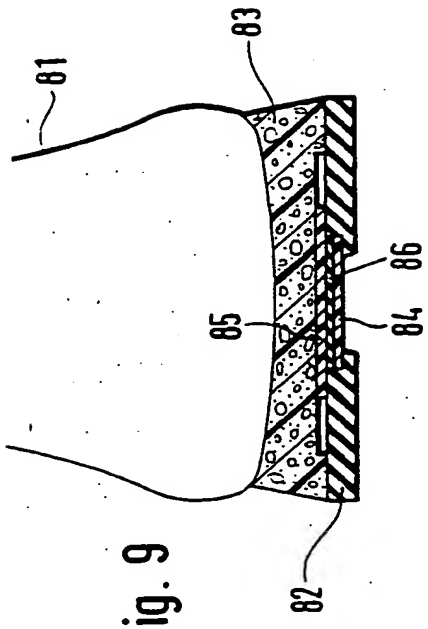

Fig. 9

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Fig. 10

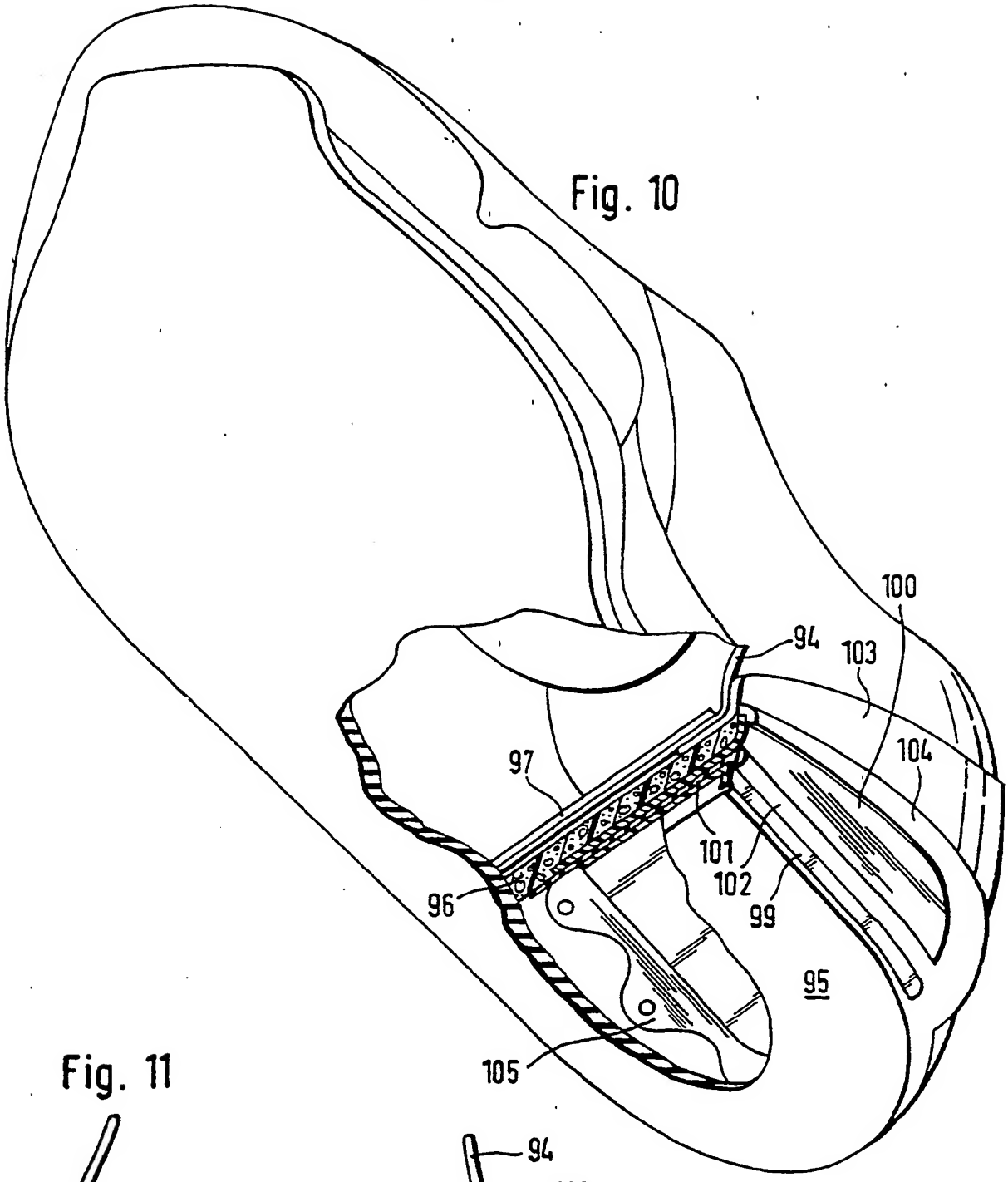
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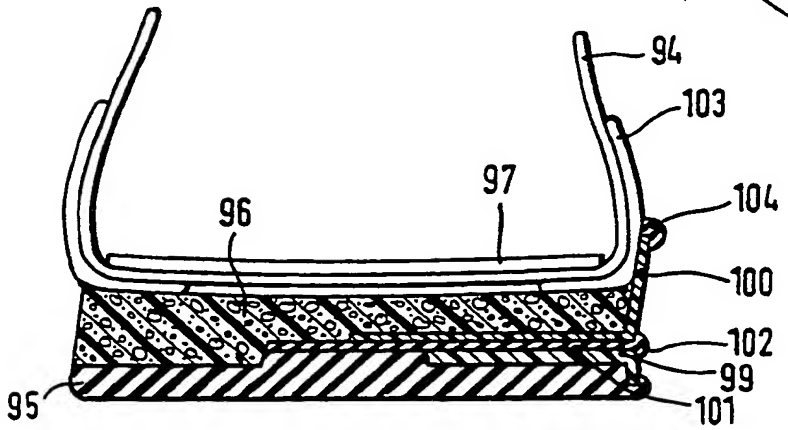
Fig. 11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SOLE AND SPORTS SHOE

This invention relates to a shoe sole, and to a sports shoe incorporating such a sole.

The mechanical demands on soles, particularly of sports shoes, are heavy and varied. Thus it is not only high strength and durable hard-wearing qualities which are required. Rather, a shoe sole, especially a sports shoe sole, must one the one hand be flexible enough (especially in the region of the front of the foot) not to restrict the mobility of the foot, and on the other hand sufficient stiffness must be achieved (especially in the ankle and heel regions) to prevent overloading of the ankle joint.

In order to fulfil these varied demands - which in part are even opposing demands - on shoe soles, particularly sports shoe soles, right, a high level of cost is necessarily incurred in the current state of the art in terms of materials and manufacturing technology. Material parts of the most different types are combined with each other; these each have to be processed and adhesively bonded to each other in numerous process steps. This necessitates careful preparation of the surfaces to be stuck together, to give but one example of the high operating cost. Furthermore, it is understood that the disadvantage of a comparatively high weight must also be accepted for soles constructed in this way.

Starting from the state of the art outlined above, the object of this invention is to reduce materials and processing requirements and cost for the manufacture of soles and hence sports shoes, without reductions having to be made in relation

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to the heavy and varied demands to which soles, particularly sports shoe soles, are subjected.

According to a first aspect of the invention, there is provided a shoe sole, particularly a sports shoe sole, wherein at least one fibre reinforced part comprising a plastic matrix with fibres inserted in it serves as a supporting component of the sole, and is inseparably attached to the remainder of the body of the sole by welding or chemical bonding.

According to a second aspect of the invention there is provided a sports shoe incorporating a sole as defined above.

The fibre reinforced part preferably has several layers of continuous, aligned synthetic fibres, most preferably in the form of textiles or lay-ups.

By means of the application according to the invention of a fibre reinforced part as the supporting component of a shoe sole, the important advantage is obtained that the outer surface of a sole comprising a thermoplastic or a thermosetting plastic can be joined to a supporting sole member of the type concerned without requiring special additional process steps for the production of an adhesive bond between the two parts. The advantageous abrasion-resistant, frictional and damping properties of numerous materials (especially elastomeric materials) which can be used for the outer surface of the sole can thus be fully utilised.

By means of the functional use of a fibre reinforced component, the sole according to the invention is characterised in particular by a low weight and a reduced wall thickness. High stiffness, with the facility of being able

moreover to select the direction of stiffening desired in each case, are further advantageous features. The sole according to the invention is thus equipped overall with the optimum flexibility and stiffness according to the type of sport. Special reinforcements for the insoles can be dispensed with.

By means of the application according to the invention of fibre reinforced parts of the type outlined above, it has now become possible to incorporate stiffening parts in sports shoe soles without adhesive bonding or even pretreatment of the stiffening parts being necessary. The invention makes it possible to form a fixed molecular bond between the stiffening parts and the elastomeric parts in such a way that no displacement movements at all can occur between the different components, and thus no nicking or cutting effects can occur.

Advantageous further forms of the invention can be inferred from Claims 3 to 7. Thus the measure which can be inferred from Claim 6 serves to achieve the object of an optimum stiffness in terms of ergonomics over the whole surface of the sole.

According to a form of construction of the invention which is very advantageous to manufacture and therefore right in practice, the body claimed in Claim 7 comprises a thermoplastic synthetic material and is attached to the fibre reinforced part or parts by welding.

Advantageous further forms of this form of construction can be inferred from Claims 9 to 12.

The invention is outstandingly characterised and suitable for the soles of cycle racing shoes, since here in

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particular it provides a high stiffness with at the same time a reduced thickness and a low overall weight. These requirements are optimally fulfilled by means of the fibre reinforced parts used according to the invention.

However, the invention can also be put into practice in a comparatively advantageous way in sports shoe soles for other types of sport, such as football, rugby, athletics (sprint soles), and American football.

The plastic materials cited in Claim 11 are necessary in order that the forces acting on the sole can be absorbed by the gripping elements.

The particular solution which can be inferred from Claim 12 imposes great demands on the quality of the welding, but offers the advantage that the whole of the surface of the shoe upper can be adhesively bonded to the sole, i.e. with the major part of its lower surface against the fibre reinforced part.

According to another very important form of construction of the invention, it is proposed that the body comprises rubber and is joined to the material of the fibre reinforced part during the vulcanisation process. In order to provide a complete understanding of this variant of the invention, it seems appropriate to give a more detailed explanation of the state of the art at this point.

As far as the sports shoe sector is concerned, and despite numerous attempts over the past 20 years to introduce other materials into sports shoe construction, vulcanised rubber has remained the dominant material for outsoles in the

fields of hiking, trekking and mountaineering boots and shoes, jogging shoes and tennis shoes. Moreover, vulcanised rubber is extensively used as the material for the soles of studded football boots. Furthermore, vulcanised rubber is usually used for the manufacture of anti-slip parts in various other soles, e.g. the soles of cycle racing shoes, skiing boots and the like.

Synthetic styrene-butadiene rubber is most frequently used. However, both natural rubber and blends of the two above-mentioned types of elastomers are also still used. Vulcanised rubber has the advantage that its coefficient of friction with respect to most surfaces is very high. This asset compared with all the other conceivable thermoplastic synthetic materials is particularly advantageous in the wet. Moreover, vulcanised rubber is soft, and therefore ensures good damping, a high level of comfort, and good accommodation on sticking the sole to the upper of the shoe concerned. It has been shown in practice that the abrasive wear of rubber elements against the multiplicity of surfaces with which they come into contact is low. Finally, vulcanised rubber is also an inexpensive material which can easily be processed simply by pressing.

However, in the field of vulcanised elastomers, foamed, cross-linked ethylene vinyl acetate is also used for the above-mentioned types of shoes, and also for other different types of shoes, as a damping throughsole between the outsole and the shoe upper (insole); in some cases it is even used as the outer surface.

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In addition to the advantages mentioned above, rubber as a material also has various disadvantages. In particular, it lacks mechanical strength and stiffness. This inadequacy might be tolerable in individual cases; but in most cases the problem is coped with by making the sole thick and therefore significantly heavier than a comparable sole made of elastomer would be. Reinforced insoles are used as a further remedy, wherein this reinforcement can be achieved by means of a plastic wedge or a steel joint. In order to compensate for the above-mentioned disadvantages of rubber as a material, further stiffening elements are also incorporated, or multilayer sole structures are used, in which only the immediate surface of the sole consists of rubber. Moreover, all sole constructions which employ rubber are characterised by the significant cost of adhesive bonding. Rubber soles usually have to be roughened, provided with lines at the front and at the back, and then activated again before pressing. If rubber soles then have to be combined with other parts (throughsoles, stiffening and support members), corresponding further adhesive bonding steps are necessary.

The inadequacies and disadvantages which were significant hitherto are avoided by means of the form of construction claimed in Claim 13, whilst at the same time fully retaining the advantages of rubber as a material, however (see above). The invention makes use of the possibility of adhesively bonding rubber to certain thermoplastics by direct moulding-on without any pretreatment. This method is fundamentally known in shoe manufacture, but

has not come into use until now. A significant reason for this may be that the plastics which were hitherto available for such bonding did not exhibit elastomeric behaviour, but exhibited a purely brittle behaviour.

The fibre reinforced parts which are employed here according to the invention are characterised by a high strength and stiffness, but nevertheless do not exhibit brittle behaviour. Direct moulding-on of the rubber is therefore henceforth possible for the first time by means of the invention.

It is clear from Claim 14 that the form of construction according to Claim 13 is particularly well suited to the soles of football boots.

Furthermore, the use of fibre reinforced parts according to the invention permits the features which can be inferred from Claim 15 to be obtained.

An advantageous alternative to the above-mentioned form of construction can be inferred from Claim 16. The individual fibre reinforced parts can be manufactured in a simple manner and without subsequent processing by punching them out from corresponding sheets (which can have a two- or three-layer construction). Pressing with the thin rubber film disposed in between can be effected in one processing step with the forming of a rubber outsole, for example. In this respect almost the only use of the thin rubber film is to adhesively bond the fibre reinforced layers.

The realisation of such a sole structure requires the use of particular combinations of materials. The features

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cited in Claim 18 are advantageous for the selection of a suitable matrix material for the fibre reinforced part. Claims 19 and 20 comprise two alternative possible actual combinations of materials.

Claim 21 discloses preferred possibilities regarding the fibre material of the fibre reinforced part. The fibres are ideally coated with a size which improves the chemical bonding capacity of the matrix material.

For the form of construction according to Claim 20, ethylene vinyl acetate (EVA) can also be moulded-on directly. By this means the direct forming of foamed EVA throughsoles is also fundamentally made possible.

It can be seen as the decisive advantage in all these cases that no pretreatment is required for any of the components. The prerequisite is merely that the fibre reinforced part has a clean surface which is free from release agents.

Claims 22 and 23 also comprise advantageous further forms of the invention.

The rubber body according to the invention enables the edge of the sole to be adhesively bonded to the shoe upper without problems, and advantageously avoids the need for reworking the cut edge of the fibre reinforced part. The particular advantage of the variant according to Claim 22, and possibly Claim 23, is that only a single material has to be adhesively bonded to the shoe upper.

In the manufacture of shoe studs from rubber it must normally be ensured that these have - at least in the region

of their bases -a comparatively large diameter and/or a comparatively low height compared with shoe studs of the same type made of thermoplastic synthetic material. Otherwise this can lead to an unsafe tread, due to the intrinsic softness of the rubber material, and even to the buckling of the heavily loaded shoe studs if treading takes place on one side, which can result in twisting of the ankle. However, the above-mentioned bulky construction of the rubber studs, which acts against this danger, results in turn in a lessened security of placement and thus in a reduced grip on soft, deep ground.

In order to avoid this disadvantage also, shoe studs made of rubber (hitherto) had to be provided in a configuration of greater density (and therefore in greater numbers, and placed nearer to each other) than would be necessary for the same type of shoe studs made of thermoplastic synthetic material; this in turn was disadvantageous, however.

All these disadvantages of rubber studs are now advantageously avoided by means of the features which can be inferred from Claim 24. The cited measures confer the advantage that the sole studs according to the invention can be designed in terms of their shape and configuration like shoe studs which consist entirely of a relatively hard thermoplastic material.

Claim 25 comprises an advantageous form of the type of construction concerned.

A further form of construction according to the invention, which is particularly suitable for use in running

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shoes, e.g. for jogging or trekking, but is also suitable for tennis shoes, is provided by the features which can be inferred from Claim 26. Excessive torsion between the front and rear of the foot, which can damage the arch of the foot, is advantageously prevented by means of a form of shoe sole of this type.

Claims 27 to 29 comprise advantageous further forms of this concept.

The features which can already be inferred from Claim 16 facilitate a particularly favourable adhesive bonding of both fibre reinforced parts, without additional processing steps, by utilising the bonding qualities of the matrix material of the fibre reinforced parts between elastomeric materials. This bonding process can be effected in a single processing step together with the forming of the rubber outsole, for example.

By means of the features according to Claim 28, a more gradual change in stiffness is achieved from the first, central, comparatively inflexible fibre reinforced part, to the edge areas of the second, comparatively flexible fibre reinforced part which overlaps the first fibre reinforced part.

One decisive advantage is that no pretreatment is necessary for any of the components. It is merely important that the surface of the fibre reinforced part or parts is clean and free from release agents.

According to a further variant of the invention, which is likewise particularly suitable for running shoes, the

measures which can be inferred from Claim 30 are proposed. The function of the first fibre reinforced part is as stated above. However, the second fibre reinforced part in the heel region has the task of acting as a pronation support. In this respect the performance of the first fibre reinforced part is greatly reinforced by the part of the second fibre reinforced part which is bent into the horizontal plane (the plane of the sole).

Advantageous further forms of the concept according to Claim 30 can be inferred from Claims 31 to 35.

The invention will now be explained in more detail by means of the examples of embodiments illustrated in the drawings, and in the following description of these embodiments, where:

Figure 1 is a perspective illustration of a sports shoe, particularly a football boot, viewed obliquely from below;

Figure 2 is a vertical longitudinal section of one form of construction of a sole for the sports shoe shown in Figure 1;

Figure 3 is a representation as in Figure 1 of another form of construction of a sports shoe, particularly a football boot;

Figure 4 is a sectional view as in Figure 2 of one form of construction of a sole for the sports shoe shown in Figure 3;

Figure 5 is a sectional view as in Figure 2 of one form of construction of a sole for the sports shoe shown in

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Figure 3, shown partially cut away;

Figure 6 is a sectional view as in Figures 2, 4 and 5 of another form of construction of a sole for a sports shoe as shown in Figure 3;

Figure 7 is a perspective illustration, viewed obliquely from below, of a further form of construction of a sports shoe (shown partially sectioned in the region of the cross-shaped insert part);

Figure 8 is a plan view, seen from below, of the sports shoe sole shown in Figure 7 (with the rubber outsole removed);

Figure 9 is a vertical section through the sports shoe shown in Figure 7 or the sports shoe sole shown in Figure 8;

Figure 10 is a perspective illustration as in Figure 7 of a further form of construction of a sports shoe with the heel region shown cut away; and

Figure 11 is a vertical cross-section through the heel region of the sports shoe shown in Figure 10.

In Figure 1 a sports shoe, e.g. a football boot, is denoted in its entirety by the reference numeral 61. It consists of an upper 62 and a sole denoted in its entirety by 70. In the form of construction of the sports shoe sole 70 shown in Figure 2, two fibre reinforced parts 71a and 71b are provided, which are placed together in the central area of the sole - near 72. The front fibre reinforced part 71a is formed so that it is transversely stiffened. "Transversely stiffened" means that the fibre layer or layers of the fibre reinforced part 71a are aligned substantially transverse to the

longitudinal axis of the sole 70. At the same time, a high flexibility of the fibre reinforced part 71a is retained in the longitudinal direction, e.g. the rolling process of the foot is not impeded.

In contrast, the second fibre reinforced part 71b, which is located in the rear region of the foot, is formed so that it is stiffened diagonally. This "diagonal stiffening" (by means of a corresponding diagonal alignment of the fibre layers) facilitates the optimum stiffness in the torsional and longitudinal directions of the sole.

As can also be seen from Figures 1 and 2, the two fibre reinforced parts 71a and 71b are bordered by an injection moulded body 63 made of thermoplastic synthetic material, which at the same time also forms the junction 72 for the two fibre reinforced parts 71a and 71b, wherein the junction extends transversely over the central region of the sole 70. The body 63 is designed for fixing threaded gripping elements (studs); these are shown as dash-dot lines and denoted by 64 in Figure 2. Figure 1 clearly shows that a total of six positions - denoted by 65 - are provided for gripping elements 64 in the body 63. In the application shown in Figures 1 and 2, the fixings for the gripping elements 64 are of conventional design; the usual plastics materials are also correspondingly used for the moulded part (the body 63).

Moreover, a particular feature of the form of construction shown in Figures 1 and 2 is that the body 63 is moulded so that it only overlaps the fibre reinforced parts 71a , 71b on the outer face (underside), and does not overlap

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the upper face which is adjacent to the shoe upper 62. In this respect it is possible to stick the complete surface of the shoe upper 62 to the sole 70, and therefore to stick the greater part of its basal surface to the fibre reinforced parts 71a, 71b.

In the sports shoe shown in Figure 3, the parts which correspond to the form of construction shown in Figures 1 and 2 are denoted by the same reference numerals used in those Figures, for the sake of simplicity and clarity. However, as distinct from Figures 1 and 2, a moulded-on rubber body is provided in the form of construction shown in Figure 3 (and the forms of construction shown in Figures 4 - 6); this moulded-on rubber body is denoted by the reference numeral 163. Rubber studs 166 are attached as one piece to the rubber body 163, as gripping elements for the sole. The transverse central region at the junction of the two fibre reinforced parts 71a, 71b is also attached as one piece to the rubber body 163; this transverse central region is denoted by 72, as in Figures 1 and 2.

A particular feature of the form of construction shown in Figure 4 is that the backs of the two fibre reinforced parts 71a, 71b, i.e. their surfaces which are adjacent to the shoe upper (62, Figure 3), are covered by a thin rubber film 73. The advantage of this variant is that only one material needs to be adhesively bonded to the shoe upper (62). Moreover, the rubber film 73 has a damping effect, which athletes have found to be pleasant.

As shown in Figure 4, the rubber film 73 can form a

one-piece component with the rubber body 163 in this respect.

Figure 5 shows another variant of a sports shoe sole. A first, transversely stiffened, front fibre reinforced part 71a which extends approximately to the centre of the sole (transverse web 72), and a second, diagonally stiffened, fibre reinforced part 71b, which extends from about the centre of the sole (transverse web 72) to the rear end of the sole, are again provided here. The upper faces (see reference numeral 62 in Figure 3) of both fibre reinforced parts 71a, 71b are covered by a continuous rubber film 76. Moreover, the fibre reinforced parts 71a, 71b are surrounded by a moulded-on rubber body 77, as in the form of construction described previously and shown in Figure 4. This moulded-on rubber body is suitably attached to the rubber film 76 as one piece. The two lateral edges of the rubber body are joined in the centre of the sole by the above-mentioned transverse web 72 - again as in the form of construction shown in Figure 4 - the outer surface of which here covers the adjoining edges of the two fibre reinforced parts 71a, 71b.

The special feature of the form of construction shown in Figure 5 is that the fibre reinforced parts 71a and, 71b have several recesses 78 into which the stud cores 79 are injection moulded. The stud cores 79 consist of thermoplastic synthetic material, preferably of polyamide 6,12. It is advisable in each case that the material of the stud core 79 is identical to the matrix material of the fibre reinforced parts 71a or 71b. In particular, this facilitates a strong bond between the material of the injection moulded stud cores

79 and that of the fibre reinforced parts 71a, 71b. Moreover, as can be seen from Figure 5, the stud cores 79 are injection moulded into the recesses 78 in the fibre reinforced parts 71a, 71b so that they overlap the latter on both faces in the form of flanges. By this means a strong overall joint for the studs is ensured.

As is also shown in Figure 5, the stud cores 79 have rubber material 80 injection moulded round them, and in this way form the complete gripping elements of the sports shoe sole illustrated. The gripping elements 79, 80 (studs), which are constructed as composite materials, thus combine the advantages of pure plastic studs with those of pure rubber studs, but avoid the disadvantages of separate designs of this type.

Figure 5 clearly shows that the rubber material 80 of the studs is identical to that of the rubber body 77 and can be joined to the latter as one piece (by vulcanisation).

Figure 6 further shows a preferred form of construction of a sports shoe sole. Regarding the rubber body 163 and the rubber studs 166 which are joined as one piece to it, this corresponds to the form of construction shown in Figures 3 and 4, so that these components are also denoted by the same reference numerals here.

As distinct from the variants shown in Figures 3, 4 and 5, the special feature shown in Figure 6 comprises the application of a single fibre reinforced part 171, which is preferably formed with transverse stiffening, continuously from the front of the sole to the back of the sole. A further

fibre reinforced part 67, which is preferably formed so that it is isotropically (i.e. uniformly in all directions) longitudinally or diagonally stiffened, is disposed underneath the continuous fibre reinforced part 171. The superimposed fibre reinforced parts 171, 67 are joined by means of a thin intermediate rubber film 68, which is moulded-on to both fibre reinforced parts 171, 67. In principle, the function of the rubber film 68 is merely to act as an adhesive between the two fibre reinforced parts 171, 67. This type of adhesive bond has the advantage that the adhesive bonding is not carried out as a separate process step, but directly during the production of the sole. The lower fibre reinforced part 171 is placed in the injection mould as in the conventional process, with the thin rubber film 68 (unvulcanised) on top of it, and the upper fibre reinforced part 67 on top of that. The mould is then closed and the actual rubber body 163 is injection moulded.

Alternatively, the unvulcanised rubber material for the body 163 can be placed in a press mould, followed by the two fibre reinforced parts 171, 67 and the rubber film 68 as described above.

Due to production engineering considerations, the thin rubber film 68 between the two fibre reinforced parts 171, 67 should not be significantly less than 0.5 mm thick. The sandwich construction which results from it ensures that the stiffness is greater than that which would be achieved by simply adding the fibre reinforced parts 171, 67. If even greater stiffnesses are desired, a thicker rubber film 68 can be selected.

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In the form of construction shown in Figure 6, the upper face of the continuous fibre reinforced part 171, which face is adjacent to the upper 62, is adhesively bonded directly to the upper 62. However, similar to the forms of construction shown in Figures 4 and 5 (see reference numerals 73 to 76 in these Figures), it is also possible here to provide a rubberised fabric on the upper face of the fibre reinforced part 171, which rubberised fabric would then have to be adhesively bonded to the upper 62.

The forms of construction shown in Figures 7 - 9 comprise a variant which is provided as being particularly suitable for jogging, trekking and similar types of sport. The upper material (e.g. leather) of the shoe concerned is denoted by 81. 82 denotes a rubber outsole which, as can be seen from Figure 7, for example, can have a tread profile (e.g. rectangular in shape). A comparatively thick, foamed throughsole 83 is inserted between the outsole 82 and the upper material 81, as can be seen in particular from Figure 9. Two fibre reinforced parts 84 and 85 are in turn embedded between the outsole 82 and the throughsole 83. A rubber sheet inserted between the two fibre reinforced parts 84, 85 is denoted by 86. This serves as a bonding layer for the production of a composite material from the two fibre reinforced parts 84, 85.

Moreover, as can be seen from Figures 7 and 8, the two fibre reinforced parts 84, 85 extend approximately over the central sole region and extend into the front and rear sole regions. The first fibre reinforced part 84 has a web-like

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part 88, which extends in the longitudinal direction of the sole, and to which two divergent extensions 89, 90 or 91 are each attached at the front and the back. The longitudinal and transverse dimensions of the web-like part 88 and the extensions 89 - 92 can be adapted to the relevant loading conditions. It has proved advisable to make the front, outside extension 90 or the rear, inside extension 91 longer than the front, inside extension 89 or the rear, outside extension 92.

In the sense of the purpose of this invention, the extensions 89 - 92 are less important than the web-like part 88, since the latter has to absorb torsional forces and to effect the introduction of a reasonable level of force into the region of the front of the foot or into the heel region.

As is shown in particular in Figure 8, the first fibre reinforced part 84, which comprises a comparatively stiff member, lies within the contours of the comparatively soft second fibre reinforced part 85, wherein the edge of the second fibre reinforced part 85, which has a larger surface area, extends outwards over the entire extent of the contours of the first fibre reinforced part 84. The two fibre reinforced parts 84, 85 are preferably joined via the interposed rubber film 86.

Alternatively, it is also possible directly to weld or adhesively bond the two fibre reinforced parts 84, 85 flat to each other, e.g. by the application of high-frequency or thermal techniques. The interposed rubber film 86 is dispensed with in these alternatives.

Furthermore, it can be seen from Figure 7, and in

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particular from Figure 8 also, that tongues 93 are formed at the edge of the second fibre reinforced part 85 which overlaps the first fibre reinforced part 84. By this means, the overall flexibility of the second fibre reinforced part 85 is further improved. However, Figure 8 also clearly shows that the second fibre reinforced part 85 is formed overall from a web-like central piece with divergent extensions attached to it at the front and the back, which essentially follow the contours of the first fibre reinforced part 84.

In relation to the construction of the two fibre reinforced parts 84, 85 in terms of the efficient use of materials, it is very advantageous in terms of simple and cost-effective manufacture if the first fibre reinforced part 84 is punched out from a fibre reinforced sheet with a multilayer structure, and the second fibre reinforced part 85 is likewise punched out from a fibre reinforced sheet (which has fewer layers than the first fibre reinforced part 84 has, however), each in their geometrical final shape (see Figure 8 in particular).

In the form of construction of a sports shoe sole shown in Figures 10 and 11, 94 denotes the upper material (e.g. leather, plastic, textile and the like), 95 denotes a rubber outsole, 96 denotes a throughsole made of foamed material and disposed between the outsole 95 and the upper material 94, and 97 denotes an insole. As can further be seen from Figures 10 and 11, a first fibre reinforced part 99 is disposed in the heel region of the sports shoe illustrated. A second fibre reinforced part 100 is formed as a shell part and

is raised externally in the heel region of the shoe upper. This serves to prevent excessive pronation. However, as is clearly shown in Figure 11 in particular, the second fibre reinforced part 100 is bent into the plane of the sole, wherein it covers the first fibre reinforced part 99. A thin rubber film 101 is inserted between the two fibre reinforced parts 99, 100 and is adhesively bonded to the two fibre reinforced parts 99, 100. The foil-like rubber film 101 therefore serves as a bonding layer for the two fibre reinforced parts 99, 100.

Alternatively, however, direct welding of the two fibre reinforced parts 99, 100 can be effected here, in which case an interposed rubber film 101 is not required.

The rubber film 101 forms a rubber lip 102 at its outer edge. The drawing clearly shows that the first fibre reinforced part 99 and the horizontally aligned part of the second fibre reinforced part 100 are disposed together with the foil-like rubber film between the rubber outsole 95 and the foamed throughsole 96. For this it is important that the parts 99, 100, 101 are directly embedded as inserted parts during the process of manufacture of the rubber outsole 95.

A further special feature is that the part of the second fibre reinforced part 100 which is bent upwards (towards the vertical) forms a reinforcing element which adjoins a reinforcing cap 103 externally. At the same time, the region of overlap between the sole 95, 96 and the adjoining upper material 94 is thus covered. The upper edge of the second fibre reinforced part 100 is covered and surrounded

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by a rubber frame 104.

A further special feature of the sports shoe variant shown in Figures 10 and 11 is that flexible tongues 105 are formed at the edge of the second fibre reinforced part 100. The tongues 105 are thus a component of the fibre reinforced part 100. The number of layers in the region of the tongues is exactly the same as in the remaining portion of the fibre reinforced part 100. In particular, the fibre reinforced part 100, including the tongues 105, is advisedly punched out from a multilayer semifinished product in sheet form.

In addition to its reinforcement of the sole 95, 96 in the heel region, the second fibre reinforced part 100 in this form of construction serves essentially as a pronation support

The invention also includes the possibility that the fibre reinforced parts 171, 85, 100 are not more flexible than the fibre reinforced parts 67, 84, 99, but rather that both fibre reinforced parts each have the same stiffness in one and the same sole.

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Claims:

1. A shoe sole, particularly a sports shoe sole, wherein at least one fibre reinforced part comprising a plastic matrix with fibres inserted in it serves as a supporting component of the sole, and is inseparably attached to the remainder of the body of the sole by welding or chemical bonding.

2. A shoe sole according to Claim 1, wherein the fibre reinforced part has several layers of continuous, aligned, synthetic fibres, preferably in the form of weaves or lay-ups.

3. A shoe sole according to Claims 1 or 2, wherein the fibre reinforced part or parts have areas of high stiffness and flexible regions, wherein a larger number of fibre layers is provided in the areas of high stiffness than in the flexible regions.

4. A shoe sole according to Claim 1, wherein a fibre reinforced part of high stiffness having a comparatively large number of fibre layers is allocated to the rear foot region (the so-called heel region), and a flexible fibre reinforced part with a lesser number of fibre layers is allocated to the front foot region.

5. A shoe sole according to Claims 3 or 4, wherein the reduction in the number of fibre layers from the area or areas of high stiffness to the flexible region or regions of the fibre reinforced part concerned is effected in at least two stages.

6. A shoe sole according to any preceding Claim

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wherein the fibre reinforced part in the front sole region (ball of the foot region) has fibre layers with fibres predominantly aligned transverse to the longitudinal axis of the sole, and the fibre reinforced part in the rear sole region (heel region) has fibre layers with fibres oriented in the longitudinal direction of the sole and/or aligned diagonally.

7. A shoe sole according to any preceding Claim, wherein the fibre reinforced part or parts is continuously surrounded at the edge of the sole by a body comprising a thermoplastic and/or elastomeric material and is or are inseparably chemically bonded to the latter.

8. A shoe sole according to Claim 7, wherein the body comprises a thermoplastic synthetic material and is inseparably joined to the fibre reinforced part or parts by welding.

9. A shoe sole according to Claim 8, wherein the body comprising thermoplastic synthetic material is joined to the fibre reinforced part or parts, which are inserted for this purpose in an injection mould, by injection moulding, wherein welding is effected simultaneously by means of the injection moulding process.

10. A shoe sole according to Claims 8 or 9, wherein the body at the same time forms bases on the underside of the sole for fastening gripping elements, e.g. football studs.

11. A shoe sole according to Claims 8, 9 or 10, wherein thermoplastic polyurethanes or (preferably softened) polyamides or polyether block amides or polyester elastomers

or elastomerically modified polypropylenes can be used as the material for the thermoplastic body.

12. A shoe sole according to one or more of Claims 7 to 11, wherein the body is arranged on and fastened to the fibre reinforced part or fibre reinforced parts in such a way that it only overlaps the same on the outer surface, and not on the back side remote from the outer surface.

13. A shoe sole according to Claim 7, wherein the body comprises rubber and is joined to the material of the fibre reinforced part during the vulcanisation process.

14. A shoe sole according to Claim 13, wherein rubber studs are disposed as gripping elements attached to the rubber body as one piece or moulded-on to the latter on a region of the rubber body which overlaps the outer surface of the fibre reinforced part.

15. A shoe sole according to any preceding Claim, wherein two fibre reinforced parts are arranged superimposed, of which one is formed so that it is comparatively flexible and extends over the other, comparatively stiff, fibre reinforced part, which has fibres oriented longitudinally or diagonally, and both fibre reinforced parts are welded or adhesively bonded flat to each other by means of high-frequency or thermally.

16. A shoe sole according to any preceding Claim, wherein at least one further fibre reinforced part with longitudinally or diagonally oriented fibres is disposed on the other side of a rubber film in the rear sole region above or below a comparatively flexible fibre reinforced part which

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runs through the complete length of the sole, and the rubber film is pressed to the two fibre reinforced parts.

17. A shoe sole according to Claim 15, wherein the intermediate rubber film is joined to the rubber body which surrounds the fibre reinforced part or the fibre reinforced parts.

18. A shoe sole according to any preceding Claim, wherein the fibres of the fibre reinforced part are embedded in a matrix material which is still stable and is not softened at the vulcanisation temperature of rubber (160 - 200 °C).

19. A shoe sole according to Claim 18, wherein the matrix of the fibre reinforced part comprises a modified polyphenyl ether which is resistant to high temperatures and the rubber body comprises styrene-butadiene rubber or a blend of styrene-butadiene rubber and natural rubber.

20. A shoe sole according to Claim 18, wherein the matrix of the fibre reinforced part comprises a modified polyamide 6,12 which is resistant to high temperatures and the rubber body comprises ethylene-propylene rubber or acrylonitrile-butadiene rubber.

21. A shoe sole according to any preceding Claim, wherein the fibre layers of the fibre reinforced part comprise weaves or lay-ups of glass, aramide or carbon fibres or hybrid structures with mixtures of the above-mentioned fibres.

22. A shoe sole according to any preceding Claim, wherein the fibre reinforced parts are coated on their back faces (remote from the outer surface) with a rubber covering of low thickness.

23. A shoe sole according to Claim 22, wherein the rubber covering is joined to the rubber body as one piece or by vulcanisation.

24. A shoe sole according to any preceding Claim, wherein stud cores made of a thermoplastic are injection moulded on to the fibre reinforced parts, which stud cores are inserted in recesses and overlap the edges of the recesses on both faces in the form of flanges, and the stud cores have the material of the rubber body injection moulded over them thus forming external rubber studs.

25. A shoe sole according to Claim 24, wherein the stud cores comprise the same material as the matrix of the fibre reinforced parts, preferably polyamide 6,12 or polyphenyl ether.

26. A shoe sole according to any preceding Claim, with a rubber outsole and a foamed throughsole disposed between the rubber outsole and the upper material of the shoe, wherein two fibre reinforced parts are disposed between the rubber outsole and the foamed throughsole.

27. A shoe sole according to Claim 26, wherein the harder first fibre reinforced part of smaller surface area is disposed adjoining the rubber outsole and the softer second fibre reinforced part of larger surface area is disposed adjoining the throughsole, i.e. above the first fibre reinforced part.

28. A shoe sole according to Claims 26 or 27, wherein tongues are formed at the edge of the second fibre reinforced part which overlaps the first fibre reinforced part.

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29. A shoe sole according to Claims 26 or 27, wherein the first fibre reinforced part is punched out from a fibre reinforced sheet with a multilayer structure and the second fibre reinforced part is punched out from a fibre reinforced sheet with a structure having fewer layers than the first fibre reinforced part, wherein each part is punched out in its final geometric shape, i.e. without subsequent working.

30. A shoe sole according to any preceding Claim, wherein a second fibre reinforced part is bent from the vertical into the plane of the sole in the sole region, and thus covers a first fibre reinforced part and is there welded or adhesively bonded to the latter.

31. A shoe sole according to Claim 30, wherein a thin rubber film, which forms a lip at the outer edge of the sole, is pressed to the fibre reinforced parts between the two fibre reinforced parts in the sole region.

32. A shoe sole according to Claims 30 or 31, wherein a rubber outsole adjoins the first fibre reinforced part below it and a foamed throughsole adjoins the second fibre reinforced part above it, in the sole region in each case, in such a way that the two fibre reinforced parts are embedded between the rubber outsole and the throughsole.

33. A shoe sole according to Claims 30, 31 or 32, wherein the second fibre reinforced part or a part of the same which is bent upwards, which overlaps the transition region between the sole and the adjoining upper material, forms a further reinforcing member which adjoins a reinforcing cap externally.

34. A shoe sole according to Claim 33, wherein the upper edge of the second fibre reinforced part which adjoins the reinforcing cap is covered and surrounded by a rubber frame.

35. A shoe sole according to any one of Claims 30 to 34, wherein flexible tongues are formed at the edge of the second fibre reinforced part.

36. A shoe sole, substantially as hereinbefore described with reference to Figures 1 and 2.

37. A shoe sole, substantially as hereinbefore described with reference to Figure 3.

38. A shoe sole, substantially as hereinbefore described with reference to Figure 4.

39. A shoe sole, substantially as hereinbefore described with reference to Figure 5.

40. A shoe sole, substantially as hereinbefore described with reference to Figure 6.

41. A shoe sole, substantially as hereinbefore described with reference to Figures 7, 8 and 9.

42. A shoe sole, substantially as hereinbefore described with reference to Figures 10 and 11.

43. A sports shoe incorporating a sole as defined in any preceding Claim.

44. A sports shoe substantially as hereinbefore described with reference to Figures 1 and 2.

45. A sports shoe substantially as hereinbefore described with reference to Figure 3.

46. A sports shoe substantially as hereinbefore

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described with reference to Figures 7, 8 and 9.

47. A sports shoe substantially as hereinbefore described with reference to Figures 10 and 11.

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Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

(i) UK Cl (Edition K) A3B

(ii) Int Cl (Edition 5) A43B

Search Examiner
J GRAHAM

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

Documents considered relevant following a search in respect of claims 1-47

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2246280 A (GEAR) see device 10	at least Claim 1
X	GB 1301571 (WRIGHT) see eg page 2 lines 50 onwards and page 3 lines 48 on	"
X	GB 991425 (ANDREWS) see page 1 lines 81 on and page 2 lines 50 on	"
X	GB 991415 (BALLY) see page 1 lines 57 on and 50 on	"
X	GB 850739 (BALLY) whole document	"
X	WO 91/09547 (TRISPORT) see page 5 line 23 on and page 8 line 1 on	"
X	EP 0147189 (CHEM) see pages 3 and 4	"
X	US 4546559 (DANSHER) see column 3 line 54 on	"
X	US 4162583 (BUSH) see column 3 line 41 on	"

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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P: Document published on or after the declared priority date but before the filing date of the present application.

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